Erratum

Endovascular Management of a Major Vascular Complication after Orthognatic Surgery

G. BENNDORF

Department of Radiology, Charite; Humboldt University Berlin, Germany

Key words: embolisation, orthognatic surgery, complication, haemorrhage

Summary

We describe the effective endovascular management of a severe haemorrhagic complication in a 24 year old man which could not be controlled by surgical means. Major bleeding caused by bilateral injured internal maxillary arteries after orthognatic surgery occurred. Angiography proved to be efficient in exactly localizing the bleeding sites while endovascular occlusion ultimately stopped the bleeding in a life-threatening situation for the patient.

Introduction

Haemorrhagic complications during or after orthognatic surgery are not uncommon [1]. Arterial bleeding as a major side effect is rare but may be caused by iatrogenic trauma particularly if the bone anatomy is unusual or vascular malformations are found.

The internal maxillary artery and its branches are most commonly the source of bleeding because they can easily be damaged during surgical preparation in the pterygopalatine fossa. Control of bleeding can be attained by surgical or endovascular techniques. If surgical means are not effective or incomplete in the management of this complication, transarterial embolisation can become a life-saving procedure.

We report a case where after Le Fort I osteotomy and bilateral sagittal split osteotomy of the mandible both internal maxillary arteries (IMA) were severely injured during mandibular surgery.

Case Report

A 24-year-old man patient was referred from another clinic after Le Fort I osteotomy. During surgery major arterial bleeding of the right internal maxillary artery had occurred. This complication was temporarily managed by pressure packing. Because it was not possible to stop the bleeding definitely by any surgical means the patient was transferred to the neurointerventional service of our hospital. Transfemoral digital subtraction angiography (DSA) had to be performed to localize the bleeding source. External carotid artery (ECA) injection on the left side showed a leakage of the inferior dental artery (IDA) about 2 cm distal to its origin causing a significant extravasation (figure 1A).

A quickly navigated microcatheter allowed selective catheterization of this branch and placement of four short fibered coils that occluded the vessel completely within minutes (figure 1B, C).

On the right side (figure 2A) a "missing" proximal part of the internal maxillary artery (IMA) but no extravasation could be seen while pressure packing was left in place. After pressure packing had been removed, angiography revealed a large leak of the proximal stem of the IMA (mandibular portion) with huge

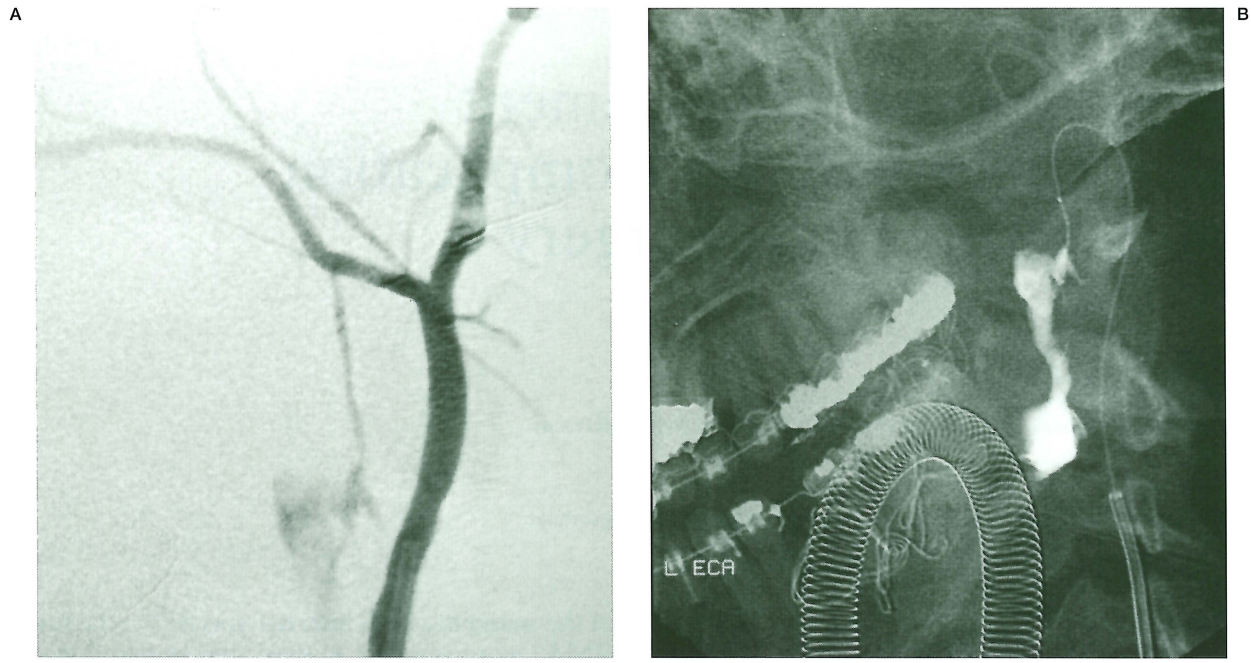

Figure 1 A) left ECA injection: major extravasation arising from the proximal inferior dental artery. B) Selective position of the microcatheter for occlusion of the bleeding site. C) Left ECA post Embo: complete stagnation of blood flow in the injured artery after placement of a few fibered coils.

extravasation (figure 2B). Placement of few fibered coils and a small amount of PVA particles (350-500 µm) closed the damaged artery (figure 2C).

No further bleeding occurred and a dramatic improvement in supportive care was seen, so that, the operation could be finished. The patient recovered completely within a few days with no neurological deficit or ischaemic problems in the maxillofacial region.

Discussion

Haemorrhage as a major vascular complication of orthognatic surgery has often been reported [1,2,3,4,5,6,7]. Lanigan [1] gave an extensive overview of 21 cases of major postoperative haemorrhages following maxillary surgery and 18 cases of intraoperative haemorrhages submitted by 5000 surgeons of North America. Out of these 18 patients six bled venously, nine arterially and the remainder had both. There was no case with a bilateral arterial haemorrhage, the majority of patients developed nose bleeds [1].

All of these complications were controlled by surgical means e.g. clipping of external carotid artery (ECA) branches, ligation of ECA, coagulation, cauterization and pressure packing. Most of these treatments have been effective, but in some cases haemorrhage recurred.

Endovascular treatment to control bleeding after maxillofacial trauma or orthognatic surgery has been described by several authors [3,4,5,6,7].

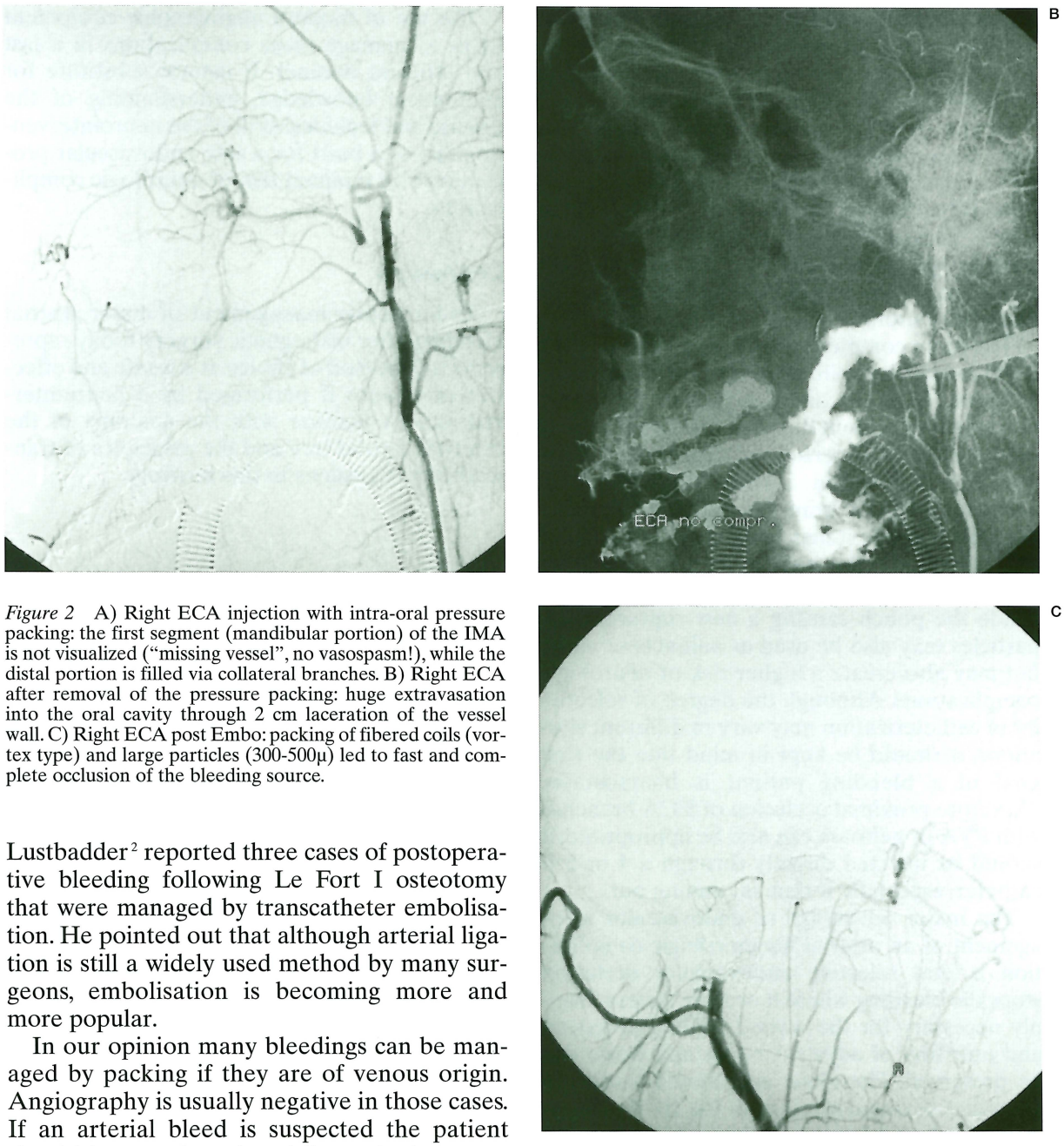

Figure 2 A) Right ECA injection with intra-oral pressure packing: the first segment (mandibular portion) of the IMA is not visualized ("missing vessel", no vasospasm!), while the distal portion is filled via collateral branches. B) Right ECA after removal of the pressure packing: huge extravasation into the oral cavity through 2 cm laceration of the vessel wall. C) Right ECA post Embo: packing of fibered coils (vortex type) and large particles (300-500μ) led to fast and complete occlusion of the bleeding source.

Lustbadder[2] reported three cases of postoperative bleeding following Le Fort I osteotomy that were managed by transcatheter embolisation. He pointed out that although arterial ligation is still a widely used method by many surgeons, embolisation is becoming more and more popular.

In our opinion many bleedings can be managed by packing if they are of venous origin. Angiography is usually negative in those cases. If an arterial bleed is suspected the patient should be transferred rapidly to the interventional neuroangiography unit. This allows fast and accurate localization of the bleeding site and helps delineate vascular abnormalities such as active leakage, false aneurysms, arteriovenous shunts or highly vascularized tumours. Lanigan[1] pointed out that leakage can only be visualized if the patient is actively bleeding during angiography and Tadwalkar[9] reported a rate of 0.5 mL/min necessary for angiographic visualization in epistaxis. Careful analysis of the images to avoid mistakes is very important, *any abnormality* in the vascular tree can be crucial.

The principle "look for the missing artery!" can be helpful in differentiating a vasospasm from an injured vessel. Pressure packing may mimic a closed vessel and therefore should be removed during contrast injections in special situations. As soon as the bleeding source is identified embolisation has to performed. The

technique and choice of embolic material depends on the given situation. For occlusion of a.v. shunting lesions or false aneurysms glue (NBCA) is probably most appropriate.

In the case described above it would also have been a good alternative to coils especially on the left side. We found the large hole of the right IMA difficult for exact deposition of glue while preserving the noninjured arteries. Further, glue deposition into the adjacent soft tissue may have induced inflammatory or necrotic reations.

The more complex configurated coils (vortex type) could be stabilized in front of the leakage without danger of distal migration. However, placement of coils in the external carotid tree is only preferable if performed directly at the fistula site and within a short time. Proximal occlusion of ECA branches with coils is unacceptable because it may worsen the situation of the patient. If the angiogram shows a false aneurysm one should beware of using coils inside the pouch causing a new rupture. PVA particles may also be used as adjuncts or alone but may also create a higher risk of neurologic complications. Although the degree of selectivity in catheterization may vary in different situations, it should be kept in mind that the first goal in a bleeding patient is haemostasis. Therefore proximal occlusion of ECA branches with PVA or gelfoam can also be appropriate: it should be injected directly through a 4 or 5 F catheter, especially if time is running out.

The major advantage of endovascular management of an arterial haemorrhagic complication is that selective endovascular occlusion stops the bleeding where it occurs[2]. Arterial supply necessary for the wound healing processes and nutrition of adjacent bones and tissue can be preserved. Therefore, one should avoid too extended devascularisation in the ECA territory especially if performed bilaterally using small embolic material (45-150μ) which can create a significantly disturbed blood supply. In a blood circulation that is already compromised it can promote ischaemic complications like aseptic necrosis as reported by Lannigan[4].

On the contrary, surgery and external carotid ligation might even be ineffective due to collaterals from the ipsilateral or contralateral vascular territory.

All patients with focal vascular lesions should be controlled by follow-up.

The use of modern angiographic equipment helps to manage these complications in a fast and efficient manner. It cannot substitute for anatomical knowledge, understanding of the disease and technical skill of the neurointerventionalist as a basis for a safe endovascular procedure with minimal risk of neurologic complications.

Conclusions

Endovascular management of major arterial bleeding after orthognatic surgery today represents the method of choice. It is a safe and effective procedure if performed by a neurointerventionalist familiar with the anatomy of the external carotid tree and the principles of transcatheter occlusions in this territory.

References

1 Lannigan DT, Hey JH, West RA: Major vascular complications of orthognatic surgery. J Oral Maxillofac Surg 48: 561-573, 1990.
2 Lustbadder DP, Schwartz MH et Al: The use of percutaneous transcatheter embolisation to control postoperative bleeding following Le Fort I Osteotomy. J Oral Maxillofac Surg 49:426-431, 1991.
3 Miller F, Entzimminger LB, Colemann LL: Sucessful catheter embolisation of a false aneurysm of the internal maxillary artery. Arch Otolaryngol 101: 517, 1975.
4 Lannigan DT, Hey J, Weat RA: Aseptic necrosis following osteotomies. J Oral maxillofacial Surg 48: 142, 1990.
5 Hemming S, Johnson R, Fereraro N: Management of a ruptured pseudoaneurysm of the sphenopalatine artery following a Le Fort I osteotomy. J Oral Maxillofacial Surg 45: 533, 1987.
6 Solomons NB, Blumgart R: Severe late onset epsitaxis following Le Fort I Osteotomy: Angiographic localization and embolisation. J Laryng Otol 102: 260, 1988.
7 Lannigan DT, West RA: Management of postoperative haemorrhage following Le Fort I maxillary osteotomy. J Oral Maxillofac Surg 42: 367, 1984.
8 Lasjaunias P, Berenstein A: Surgical Neuroangiography. Vol. 2: Endovascular treatment of craniofacial lesions. Springer, Berlin, Heidelberg, New York 1987.
9 Tadwalkar V, Santos V, Polisar I: Angiography in the treatment of severe epistaxis. Ear Nose Throat J 64: 60, 1985.

Goetz Benndorf, M.D.
Neuroangiography
Dept. Radiology
Charite Virchow Hospital
Humboldt University Berlin
Augustenburger PL. 1
13353 Berlin (Germany)